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Do networks of financial intermediaries help reduce local bias? Evidence from cross-border venture capital

Abstract

Contributing to the literature on local bias, we examine how the direct and indirect network ties of financial intermediaries mitigate two types of information problems, the identification of investment opportunities and the evaluation of their quality. In our analysis of the non-domestic IPOs and trade sales exits of European venture capital-backed companies, we find that direct and indirect network ties differ in their capability to alleviate the two information problems: indirect ties to partners' partners, with their broad reach, help alleviate the identification problem but direct ties, with their stronger certification effects, are needed to resolve the quality evaluation problem.

JEL classification: G14, G15, G24, M13

Keywords: Local bias; Information asymmetry; International investments; Venture capital

The purpose of this paper is to examine how the networks of financial intermediaries affect the distribution of information over distances. We combine insights from the emergent literature on financial networks (Hochberg, Ljungqvist, and Lu (2007)) with the well-documented bias of investors towards local investment targets (e.g. Coval and Moskowitz (1999))[1], and observe that networks of financial intermediaries mediate information and induce investments from geographically and culturally distant investors. Thus, we suggest that in addition to geographical and cultural proximity, social proximity between the investor and the target also facilitates information acquisition.

To test this proposition, we examine how the international syndication networks of venture capitalists (Hochberg et al. (2007)) help mitigate two key information problems related to non-local investments: 1) the identification of investment opportunities, and 2) the evaluation of their quality. Specifically, we examine the question of what type of information these networks can mediate and to what extent they mitigate the negative effects of geographical distance. While the extant research demonstrates the effects of contacts and networks on the information acquisition and decision making of investors (Agnes (2000), Garmaise and Moskowitz (2003), Gompers and Xuan (2008), Hochberg et al. (2007), Hong, Kubik, and Stein (2004), Hong, Kubik, and Stein (2005), Sorenson and Stuart (2001)), it leaves two gaps in answering this question. First, the research has mainly addressed contacts using proxies such as distance (e.g. Hau (2001b)), group membership (e.g. Hong et al. (2004), Duflo and Saez (2002)), or shared location (e.g. Hong et al. (2005), Kelly and Grada (2000)). While these measures partially capture the effect of contacts, they are unable to differentiate between direct and indirect ties, that is, whether information was received directly from the source or whether it was spread by word of mouth. Second, the few studies that explicitly address the actual contacts

[1] This preference is illustrated, for example, by investors' tendency to overemphasize domestic stocks in their portfolios (French and Poterba (1991), Tesar and Werner (1995), Cooper and Kaplanis (1994), Ahearne, Griever, and Warnock (2004)), to direct their investments to geographically close markets (Portes and Rey (2005)), and to use local exchanges for trading (Tse (1999)). Earlier research has identified two main sources for this bias. First, the 'home bias' literature focuses on investment barriers between national markets, such as governance practices and investor protection (Dahlquist, Pinkowitz, Stulz, and Williamson (2003), Doidge, Karolyi, and Stulz (2004), political risks (Stulz (2005), restrictions on capital controls (Chan, Covrig, and Ng (2005)), and taxes (Chan et al. (2005)) However, many studies find that barriers to investment offer only an incomplete explanation for the bias (e.g. Cooper and Kaplanis (1994)). Consequently, the second stream, 'local bias' literature, has focused on information concerns between local and non-local investors (Coval and Moskowitz (2001), Coval and Moskowitz (1999), Grinblatt and Keloharju (2001), Ivkovic and Weisbenner (2005)). Short distances (Degryse and Ongena (2005), Lerner (1995)) and a shared language and culture between investors and investment targets (Grinblatt and Keloharju (2001), Hau (2001b), Sarkissian and Schill (2004), Chan et al. (2005)) have been found to facilitate greater familiarity with investment targets (Coval and Moskowitz (1999), Huberman (2001), Dvorak (2005)). For reviews on the topic, see Lewis (1999) and Karolyi and Stulz (2003).

between investors do not consider how network ties mitigate the effects of distance. They either focus solely on the direct contacts of the intermediaries (Garmaise and Moskowitz (2003), Sorenson and Stuart (2001), Uzzi (1999)), do not consider the effects of distance (Shane and Cable (2002)), or focus solely on network-level aspects, such as the centrality of an intermediary in a network (Sorenson and Stuart (2001), Hochberg et al. (2007)). Thus, we aim to address this gap by explicitly analyzing the effects of both direct and indirect ties, their effect on mediated information, and how they mitigate the effects of distance.

We examine the roles of the direct and indirect network ties of financial intermediaries as mechanisms for mitigating identification and evaluation problems in the context of international venture capital markets, in which the effects of imperfect information can be expected to be particularly pronounced. To compare the roles of direct and indirect network ties, we contrast the two main venture capital exit methods, initial public offerings and trade sales exits. In initial public offerings (IPOs), which are visible offerings offered in a centralized fashion to a large group of investors, the identification of the opportunity is a lesser problem, but the assessment of the quality of the firm being offered is often difficult for investors. We expect the certification effects from direct ties to be particularly important in mitigating this quality assessment problem (Megginson and Weiss (1991)). In contrast, trade sales exits are sales of a unique asset to one buyer, who usually has good resources with which to analyze the quality of the asset. However, in the decentralized market for mergers and acquisitions, the identification of an investment opportunity is a much greater problem (Rhodes-Kropf and Robinson (2008)) that needs to be overcome before a transaction can happen. In spreading the word about an investment opportunity, the broad reach achieved through indirect ties to partners' partners (Granovetter (1973), Koka and Prescott (2002), Singh (2005), Hong et al. (2005)) is expected to play an important role.

We used a sample of 4559 European venture capital-backed companies to test these hypotheses. Our analyses proceeded in two steps. First, utilizing survival analysis, we estimated the effects of direct and indirect ties to non-local markets on the risk of a non-domestic exit. We found that, after controlling for endogeneity, direct and indirect foreign network ties increase the likelihood of non-domestic exits, and direct network

ties contribute specifically to the likelihood of non-domestic IPOs. Second, using logistical regressions, we estimated the effect of network ties on the likelihood of an exit to a given market. Our results indicate that network ties affect the selection of the exit market, making an exit to those markets to which the venture has pre-existing network ties more likely. Additionally, direct ties to a given market increase the likelihood of an exit through an IPO to that specific market, while indirect ties increase the likelihood of an acquisition exit to that specific market. The results indicate that: 1) direct and indirect network ties provide a mechanism for information distribution; 2) information distributed by network ties alleviates the effects of a preference for proximity, and 3) direct and indirect network ties differ in their capability to alleviate the problems: indirect ties to partners' partners, which have a broad reach, help alleviate the identification problem, while direct ties with stronger certification effects are needed to alleviate the quality evaluation problem.

The rest of the paper is structured as follows. Section I introduces the theoretical arguments and hypotheses. Section II presents the empirical setting and sample construction. Section III presents our results on the effect of the network ties of non-domestic exits, and in Section IV, we analyze the exit destinations of non-domestic exits. Section V concludes the paper.

I. Investor Networks and Local Bias

A. Network as Mechanism for Information Distribution

Geographically distant investors have a reduced ability to receive information regarding the existence and characteristics of potential investment targets[2]. This hinders both the identification of potential targets and the acquisition of detailed information for the purpose of the evaluation of their quality, implying two types of information-related

[2] Evidence for the superior information of local investors comes from the patterns of international investment flows (Ahearne et al. (2004), Brennan and Cao (1997), Brennan, Cao, Strong, and Xu (2005)), and the superior performance of locally embedded investors (Choe, Kho, and Stulz (2005), Coval and Moskowitz (2001), Dvorak (2005), Hau (2001b), Hau (2001a), Ivkovic and Weisbenner (2005), Shukla and Inwegen (1995)). Examining the returns on the investments of US households, Ivkovic and Weisbenner (2005) find that local investments generate an additional 3.2% annual return relative to non-local investments, suggesting that the preference for local investments is based on superior information to an economically significant degree. However, the evidence on performance is not fully consistent, as Grinblatt and Keloharju (2001) found that foreign investors performed better than the locals in the Finnish market. This finding, however, was attributed to the higher level of competence of foreign investors. Accordingly, Dvorak (2005), examining Indonesian markets, finds that while foreign customers of global brokerages perform better than locals using local brokerages, locals using global brokerages perform better than either of the other groups. Additionally, stock reactions to global issues (Chaplinsky and Ramchand (2000)) and to changes in disclosure practices (Leuz and Verrecchia (2000)) demonstrate the superior initial information endowment of local investors. Finally, local analysts are more accurate and have a greater impact on prices than other analysts (Malloy (2005), Bae, Stulz, and Hongping (Forthcoming)).

problems: (1) problems related to the identification of investment opportunities (Stigler (1961), Merton (1987)), and (2) problems related to the evaluation of the quality of investment opportunities (Akerlof (1970), Megginson and Weiss (1991)). While the lack of information on the existence of an investment target simply leads to ignorance, a reduced ability to receive information erodes confidence in the completeness and trustworthiness of the information on the investment target ((Hirshleifer (2001), Huberman (2001)) and creates an information asymmetry between local and non-local investors (Brennan and Cao (1997), Coval and Moskowitz (1999), Brennan et al. (2005), Portes and Rey (2005)).[3] This effectively restricts the set of investments targets the investors are both aware of and confident enough to consider as potential investments.

From the perspective of firms seeking financing, the investors' preference for investing in local targets reduces the opportunities of firms to receive financing from non-local investors.[4] To become recognized and evaluated as a potential investment target by investors outside the local context[5], firms seeking financing need to increase their visibility in general or otherwise facilitate the transmission of information to potential investors[6]. However, the increased visibility should not be interpreted strictly as meaning visibility in a given medium or a marketplace, but rather as the opportunity for investors to receive information on a firm through any given channel. Indeed, earlier research has demonstrated the effect of contacts on the information acquisition and decision making of investors (Agnes (2000), Garmaise and Moskowitz (2003), Hochberg et al. (2007), Hong et al. (2004), Hong et al. (2005), and Sorenson and Stuart

[3] From the rational perspective, imperfect information increases uncertainty regarding expected returns. Consequently, to counter the increased risks, a non-local investor may increase the required return on the investment (Epstein and Miao (2003), Gehrig (1993), Uppal and Wang (2003)), or, alternatively, recognize the potential information asymmetry and keep from investing so as to avoid bidding against locals with better information access (Brennan and Cao (1997), Coval and Moskowitz (1999), Brennan et al. (2005), Portes and Rey (2005)). Alternatively, incomplete information, return ambiguity, and unfamiliarity with the investment target may also induce a non-rational reaction, as investors tend to have a behavioral aversion to perceived ambiguity (Sarin and Weber (1993), Heath and Trevsky (1991)), perceive unfamiliar investments as being riskier (Hirshleifer (2001)), and generally have a psychological bias against the unfamiliar (Hirshleifer (2001), Huberman (2001)).Thus, a reduced ability to receive information erodes confidence in the completeness and trustworthiness of the information on the investment target.

[4] The bias for proximity also affects firms seeking financing. Even those firms that aim to proactively increase their visibility by establishing a presence in non-local markets largely reflect the same home bias in their market decision as investors do. Firms tend to choose those foreign locations that are close to their home market rather than those that would maximize their exposure to previously unaware investors (Sarkissian and Schill (2004)). Additionally, listing in foreign markets does not seem to attract new investors, but rather serves as a means to create a new marketplace for pre-existing investors from that market (Kang and Stulz (1997)).

[5] Local is defined here as an investor residing within the same region or national borders (Coval and Moskowitz (1999), French and Poterba (1991)), sharing the same culture (Grinblatt and Keloharju (2001)), or belonging to the same social groups (Hong et al. (2004)) as the venture.

[6] Accordingly, when non-local investors do invest, they tend to prefer investments with higher visibility, such as larger firms (Kang and Stulz (1997), Coval and Moskowitz (1999)), firms that have more exports (Dahlquist and Robertsson (2001)), and firms that have placed the financial instruments of the firm for trading in non-local markets (Foerster and Karolyi (1999)).

(2001)). Evidence from group memberships (e.g. Hong et al. (2004), Duflo and Saez (2002)), the effects of shared location (e.g. Hong et al. (2005), Kelly and Grada (2000)), and the centrality of an intermediary in an industry network (Sorenson and Stuart (2001), Hochberg et al. (2007)) demonstrate that investors' social contacts affect their opportunities to receive information on potential targets and thereby affect their investment choices. In addition, the firms' existing direct and indirect ties to investors increase their chances of securing financing (Shane and Cable (2002).

While the effects of network ties described above have been examined within shared geographical contexts, networks also appear to mediate information effectively across geographical distances. Sorenson and Stuart (2001), examining the syndication networks of venture capitalists within the United States, observe that the more centrally positioned a VC firm is within these networks, the more likely it is to invest in geographically distant targets as a result of its ability to receive information on potential targets through its direct and indirect ties. Thus, the networks of financial intermediaries and investors (Pollock, Porac and Wade (2004), Garmaise and Moskowitz (2003), Hochberg et al. (2007), Huang, Shangguan, and Zhang (Forthcoming)) appear to provide an effective channel to distribute information on investment targets over distances. For firms seeking financing, this suggests that the network ties of intermediaries to non-local investors provide a mechanism for information distribution, effectively mitigating the effects of distance and the resulting proximity preference.

B. Effect of Direct and Indirect Ties on the Mediated Information

We expect the effectiveness of this mechanism and the nature of the mediated information to depend on how directly the intermediaries connect the firms to non-local markets. The connection to a focal market is direct if the intermediary resides in that market and indirect if the intermediary resides in another market, but has direct connections to investors or intermediaries in the focal market. Both direct and indirect ties offer a medium for the distribution of information, although the nature of the information distributed depends on how strong and direct the tie is (Sorenson, Rivkin, and Fleming (2006)). Generally, the more direct and the stronger a network tie is, the more diverse and rich the information transferred through the tie will be (Koka and Prescott (2002), Uzzi (1999)). While the richness of mediated information is reduced as

ties become weaker and more indirect, these ties facilitate word of mouth and are effective in distributing information beyond strong direct ties, thus expanding the reach of the network (Granovetter (1973), Koka and Prescott (2002), Singh (2005), Hong et al. (2005)).

In the non-local context, we expect direct ties to have an additional effect that will enhance the information distribution and reduce the local bias of investors. The association with a financial intermediary serves as a signal for the quality of the item being sold if the intermediary has non-recoverable investments in reputational capital as a guarantee for the quality, linking the future profits of the intermediary to the correctness of the certification of a specific transaction (Booth and Smith (1986), Klein and Leffler (1981)). The association with a financial intermediary provides these benefits only if the intermediary is embedded in the context of the investor. Otherwise, this association has only a reduced effect, as the information on the potential incorrectness of the certification may not affect the reputation and reach audiences in other contexts (Raub and Weesie (1990), Spence (1973)).

Thus, we expect direct network ties to non-local markets to facilitate the distribution of richer and more credible information than indirect ones. This suggests that direct and indirect ties have differing abilities with respect to solving the two information problems, the identification of investments and the evaluation of their quality. On one hand, we expect an indirect tie to non-local investors to be a mechanism sufficient to facilitate investments if the investors are ignorant of the existence of the firm, but have the ability to assess its quality once they are informed. On the other hand, we expect richer and more credible information mediated through direct ties to non-local investors also to facilitate investments from investors who suffer from evaluation problems.

II. Empirical Setting

A. Cross-Border Venture Capital Exits

To analyze the role of direct and indirect ties in alleviating different types of information problems, we investigate the non-domestic exits of venture capitalists from their portfolio investments. Two important characteristics of the venture capital industry that make this context especially interesting and suitable for our analyses are: 1)

frequent asset sales, and 2) the syndication of investment, which creates a traceable network of formal contacts (Hochberg et al. (2007)). In our analysis of information problems, we focus specifically on cross-border trade sales and IPOs to non-local markets, given the heightened role of information problems caused by distance and national boundaries.

Venture capitalists invest the commitments of financial institutions, corporations, and wealthy individuals to small, unquoted companies (Sahlman (1990), Wright and Robbie (1998)). The returns are generated through the growth of the value of the individual investments, and they are realized as the venture capitalists exit their investments by selling their interests. Initial public offerings and trade sales are the two most profitable exit mechanisms of venture capitalists (Bygrave and Timmons (1992), Cochrane (2005)). Other exit routes, such as secondary sales, buy-backs, and write-offs, are rarely actively sought after.

What makes the choice between the main types of exits particularly attractive for our study is that the two main exit mechanisms, IPOs and trade sales, are affected differently by the two information problems of opportunity identification and quality assessment. While in both IPOs and trade sales the whole company or a significant proportion of it is sold to third parties, an acquisition is characteristically conducted by an individual firm or small investor group, typically from the same industry or a related one. In contrast, in an initial public offering, the investor base is considerably larger and less informed on the specifics of the underlying business. Consequently, in IPOs, the potential investors have less ability to observe and analyze, and subsequently monitor and influence, the listing venture than in acquisitions. In trade sales exits, the buyers are decentralized and there are only a small number of potential candidate companies that can carry out a thorough due diligence process and thereby become well informed as buyers. Thus, while in IPOs the offering is widely advertised, in acquisitions, making the potential acquirers knowledgeable about the existence of the investment opportunity requires more effort. While both identification and quality assessment are likely problems in both types of exits, concerns about quality are more emphasized in IPOs and the limited awareness of potential buyers regarding the existence of the acquisition target is more crucial in trade sales.

B. Networks of Venture Capitalists

Venture capitalists have extensive and effective contacts with executives, auditors, consultancies, investment banks, and corporations. These contacts allow venture capitalists to support their portfolio companies in recruitment (Gorman and Sahlman (1989), Hellmann and Puri (2002)), financing (Barry, Muscarella, Peavy, and Vetsuypens (1990), Megginson and Weiss (1991)), alliances (Stuart, Hoang, and Hybels (1999), Lindsey (2008)), and acquisitions (Gans, Hsu, and Stern (2002)). Accordingly, the contacts of venture capitalists have been seen as one of their most valuable contributions to their portfolio ventures (e.g. Fried and Hisrich (1995), Hsu (2004), Sapienza, Manigart, and Vermier (1996)). As venture capitalists co-operate actively with their peers (Bygrave (1987), Wright and Lockett (2003), Lerner (1994)), these co-operative ties connect them to a network of venture capitalists, which provides individual VCs with indirect ties to the contacts of other venture capitalists. These direct and indirect ties provide an effective channel for communication and information transfer. Its effects are demonstrated e.g. in the distribution of information regarding investment opportunities (Sorenson and Stuart (2001)). In addition, association with venture capitalists has been found to provide firms with certification (Lee and Wahal (2004), Megginson and Weiss (1991), Barry et al. (1990)) for their quality. That is, information distributed through the direct ties of the venture capitalists appears to bring benefits derived from the explicit association with the venture capitalist.

Accordingly, building on the theoretical discussion, we expect, on the one hand, the direct and indirect network ties of venture capitalists to offer a medium for information distribution regarding the existence and characteristics of the portfolio companies over distances, and, on the other hand, the direct ties to distribute richer and more trustworthy information than the indirect ties. We suggest and test two sets of hypotheses regarding the effect that venture capitalists' network ties have on the exit types and exit destinations of the ventures. First, we hypothesize that *the more direct and indirect ties a venture has to non-domestic markets, the more likely it is to make a non-domestic exit*. We should observe that direct connections to non-domestic markets increase the likelihood of both stock listings and acquisitions in non-domestic markets, as they reduce the recognition and confidence problems. Furthermore, we should

observe that indirect ties to non-domestic investors increase the likelihood of acquisitions rather than IPOs, as they provide a wide reach of information mitigating the recognition problem, but are not likely to alleviate the recognition problem.

Second, we expect that the direct and indirect ties should also affect which specific market the exit is made to. Specifically, we hypothesize that *firms that make a non-domestic exit are more likely to make an exit to a market that it has either direct or indirect ties to*. In addition, we expect the type of ties to a specific market to affect the type of likely exit to this market. Direct ties increase the likelihood of an IPO to a specific market, while indirect ties increase the likelihood of an acquisition from the market. Finally, as the network ties to non-domestic markets are based on established, pre-existing inter-organizational network ties among the venture capitalists we expect these ties, once they have been established, to mediate information despite this distance, thus reducing the negative direct effect of distance on the likelihood of an exit to a specific market.

III. Data

A. Sample Selection

To test our hypotheses and to model the effects of direct and indirect ties of venture capitalists on the distribution of information, we analyzed longitudinal venture capital investment data from 14 European countries.[7] We observed the financing rounds for these ventures, identified their investors, and defined their nationalities using the SDC Venture Economics database. This database, which contains the VC investments and detailed information on the nationalities and the investors who have invested in the ventures, has been widely used in venture capital research (Kaplan and Stromberg (2004), Lerner (1994), Hochberg et al. (2007))[8]. We augmented the Venture Economics

[7] Our sample countries include 14 of the 15 EU countries in 1995: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Portugal, the Netherlands, Spain, Sweden, and the United Kingdom. These countries are of comparable size and as members of the EU they share relatively harmonized economic conditions and legislation. We excluded Greece, the remaining member of the EU-15, from our analyses, as a detailed analysis of Greek investments indicated that the data on these investments were unreliable. Thus, we excluded the 27 investments the databases recorded for Greece. For the sake of robustness, we estimated the models that also include the Greek investments, finding no qualitative differences.

[8] While being the most comprehensive database on European-wide investment level data, Venture Economics does not contain records of all investments. On aggregate level, the yearly statistics of European Venture Capital Association (EVCA) provide information with nearly exhaustive coverage. However, this information is not available on investment level. A comparison between the investment volumes reported by EVCA and Venture Economics suggests the larger the market and the later the sample year, the better the coverage is. To ensure the robustness of the results, we executed auxiliary analyses limiting the sample on one hand to five largest markets (France, Germany, Netherlands, Sweden, UK), and on other hand to last four years of the sample period, i.e.

data with data from other SDC databases to reliably record the exit data for investments. While the Venture Economics database includes some records for exits, they generally apply only for the most recent situation, and thus we were unable to identify investments with multiple investments and exits. To improve the robustness of our records on exits, we compared the data from two other databases, SDC New Issues and Mergers and Acquisitions. We compared the records of these databases against the ventures in our sample, and identified the exits for the sample ventures.[9]

Our sample consists of 4559 European venture capital-funded companies that received their first investment round between 1990 and 2002, and 1071 exits that these ventures made before the end of our observation window in June 2008. To ensure that the ventures were comparable in terms of how established and known they were, we examined only the investments in and exits from those ventures that were founded less than ten years[10] before the first investment and did not have a history of earlier investments and exits. Thus, the ventures entered our sample as they received their first investment from an external investor, and exited from the sample when they were either listed or acquired. Any further investments and exits after the first exit were excluded. Furthermore, to ensure that the interests and investment motives of the investors were alike, our sample included only those ventures that had a venture capitalist or private equity investor in the investment group, identified as "Private Equity Firm Investing Own Capital" by the database.

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years 1999-2002. The results from these analyses were qualitatively largely identical to those presented below, with the exceptions discussed in section IV.D on p.20.

[9] Since the Venture Economics, New Issues, and Mergers and Acquisitions databases do not follow fully coherent naming of the companies, we constructed a matching algorithm to combine the records for the databases. We combined the records using the CUSIP codes and the company names to identify related records. For company names, we used the current, former (FKA), and alternative (AKA) names, excluding abbreviations that were common sources of errors, such as Ltd., Gmbh., and N.V. We matched the records where either the name or CUSIP or both were identical. We additionally required the nation for the companies to match across records.

To ensure that our algorithm functioned correctly, we manually checked a random sample of 200 companies, drawn from the Venture Economics database. For these companies, we searched the New Issues and Mergers and Acquisitions databases manually, assuming only that the first letters of the names were correctly recorded. The algorithm was able to identify 94% of the sample records correctly, while in 6% of the cases the CUSIP was missing and the names did not contain hints that would have made automated matching possible. The algorithm did not produce false matches.

Furthermore, to investigate whether the databases themselves contained correct records on the exits, we validated the exit histories for the 200 companies from external sources. In 9.5% of the cases either the M&A or IPO database did not contain a record of an exit that had occurred. Consequently, combining the matching and missing records, we observe approximately 15% fewer exits than what the actual number would be. However, as this bias is downwards, it tends to make our statistical tests more conservative.

[10] To test the effect of this choice, we tested with multiple choices of the venture age used for the sample definition. The qualitative results of our analysis were not affected by this choice.

B. Cross-Border Venture Capital Exits

We identified the exit destinations and types of those 1071 ventures in our sample that were listed or acquired. We used the SDC's Venture Economics, Merger and Acquisitions, and New Issues databases to define the nationality of the venture and its new owners, and recorded the exit as non-domestic if the buyer resided in a different country from the venture. In IPOs, we recorded the exit as non-domestic if the stock was listed in the IPO on a non-domestic stock exchange. If the venture still remained in the portfolio of the venture capitalist or it had gone bankrupt, we recorded an indicator for 'no exit'.

Panel A of Table I presents a yearly breakdown for our sample of 4559 ventures describing the number of ventures, exit destinations, and exit types. The investment activity reflects the peak of the cycle in 2000, which represents 34% of the investments. We observe 1071 exits, representing an exit ratio of 20.4%. 437 (40.9%) of these exits found new investors from the non-domestic market, 90% through an acquisition and the remaining 10% through an IPO. As expected, the share of IPOs is lower in non-domestic than in domestic exits, where 30.3% of the exits were made through an IPO.

The share of exits decreases yearly from the 51% of 1990 to the 20% of 2002, demonstrating the presence of right censoring for exits. As our observation window for the exits ends in June 2008, we did not observe all the potential exits, especially for the most recent investments.[11] While we use duration analysis to control for the right censoring, we additionally checked the robustness of the results by using a restricted sample and analyzing only those investments that had received first-round financing by the end of the year 1998. The results from these analyses are qualitatively identical to those presented below.

[11] The median time to exit for sample companies with first investments prior to the year 1995 is 5.3 years. Therefore, by June 2008, approximately half of the potential exits for investments made prior to the end of the sample period, 31.12.2002, had been realized.

Table I
Descriptive Statistics

The sample consists of 4559 ventures matching the following criteria: first investment received 1.1.1990-31.12.2002 at the age of nine years or less, investor group includes at least one private and independent venture capital organization, and the venture originates from one of the EU-15 countries, excluding Greece. Panel A reports the yearly frequencies for first investments in sample ventures, exits from the ventures, exit destinations (domestic/non-domestic), and exit types (IPO/acquisition). The exit frequencies are reported for the years when the first investment in the exited venture was made. In addition, the table reports the yearly ratio of exited ventures to all ventures, and the average time to exit reported in days. The time to exit is calculated from the date of the first investment to either the IPO issue date or effective acquisition date. Panel B presents the number of ventures and exit destinations for each sample country. Panel C presents the number of direct and indirect ties the sample ventures have both to non-domestic markets and to the specific market nations.

Panel A Number of ventures, exits, types, and destinations per year

Year of first investment	Ventures	Exits	Non-domestic acquisition	Non-domestic IPO	Domestic acquisition	Domestic IPO	Share of exits	Average time to exit in years
1990	37	20	6	3	8	3	54%	8.5
1991	62	17	7	1	6	3	27%	6.4
1992	70	33	5	3	14	11	47%	5.0
1993	56	25	4	2	15	4	45%	5.4
1994	77	34	13	3	11	7	44%	5.4
1995	116	47	19	2	18	8	41%	5.6
1996	223	84	25	5	34	20	38%	4.7
1997	157	56	15	1	31	9	36%	5.4
1998	319	97	43	2	33	19	30%	4.4
1999	679	200	71	7	86	36	29%	3.9
2000	1519	263	104	3	120	36	17%	4.2
2001	874	128	54	4	54	16	15%	4.0
2002	370	67	31	4	27	5	18%	3.3
Total	**4559**	**1071**	**397**	**40**	**457**	**177**	**23%**	**4.4**

Panel B Number of ventures and exits for sample nations

Market nation	Ventures	Share of sample	Exits	Exits / ventures	Non-domestic exits	Non-domestic / all exits
Austria	62	1.4%	6	9.7%	3	50.0%
Belgium	134	2.9%	28	20.9%	20	71.4%
Denmark	125	2.7%	24	19.2%	12	50.0%
Finland	199	4.4%	37	18.6%	18	48.6%
France	725	15.9%	180	24.8%	67	37.2%
Germany	886	19.4%	150	16.9%	68	45.3%
Ireland	123	2.7%	28	22.8%	20	71.4%
Italy	121	2.7%	34	28.1%	14	41.2%
Luxembourg	14	0.3%	5	35.7%	4	80.0%
Netherlands	236	5.2%	41	17.4%	27	65.9%
Portugal	50	1.1%	3	6.0%	1	33.3%
Spain	197	4.3%	26	13.2%	9	34.6%
Sweden	305	6.7%	68	22.3%	40	58.8%
United	1382	30.3%	441	31.9%	134	30.4%
	4559		**1071**		**437**	

Panel C Ties to non-domestic markets

	All 4559 ventures		437 ventures with non-domestic exit	
	Direct	**Indirect**	**Direct**	**Indirect**
Share of ventures having non-domestic ties	61%	69%	74%	86%
When ties exist:				
Number of non-domestic ties				
Mean	1.95	125.50	2.37	167.65
Standard deviation	1.62	202.43	2.02	236.71
Maximum value	15	2182	15	1795
Number of markets to which ventures have ties				
Mean	1.41	9.77	1.59	11.72
Standard deviation	0.77	7.63	0.95	8.08
Maximum value	9	33	9	31
Number of ties to those markets to which ties exist				
Mean	1.38	12.84	1.49	14.31
Standard deviation	0.93	52.89	1.04	58.66
Maximum value	11	1826	8	1607

C. Direct and Indirect Cross-Border Venture Capital Network Ties

To measure how connected a venture was to non-domestic markets, we examined the structure of its investor group in terms of both the nationalities of the investors and the nationalities of the syndication partners of its investors. We constructed two sets of measures for both types of ties. First, for the purposes of analyzing the effect of network ties on non-domestic exits in general, we measured the direct and indirect network ties to non-domestic markets, classifying the nationalities of investors and their ties on the level of 'domestic' and 'non-domestic', depending on whether or not the investor or their ties resided in the same market as the focal venture. Second, for the purposes of the second set of analyses, we differentiated with respect to market nationalities, constructing the measures as the number of direct and indirect network ties to specific markets.

To measure the direct ties to non-domestic markets in general and to specific non-domestic markets, we first identified the nationalities of the venture capitalists using the records of the Venture Economics database. We then counted the number of investors whose nationality was different than that of the focal venture. Finally, depending on the level of analyses, we either counted the number of non-domestic investors in the venture's investor group, or, for the market-specific analyses, we counted the number of

investors in the investor group that came from the specific non-domestic market, and recorded the number for each venture-market pair separately.

Second, to measure the indirect ties of a venture to non-domestic markets, we examined the number and nationalities of the syndication partners of its investors. First, to identify these indirect ties, we formed a dynamically updated syndication network by observing all the investments recorded in the Venture Economics database that were made between the years 1987 and 2002. To identify all the existing and active co-operation relationships for each investor, we recorded the ties for a given year on the basis of the investments that occurred within the last three years prior to the date. As a result, we had for each venture capitalist a record of the identities and nationalities of their investment partners from the past three years. We then connected these records to each sample venture by first identifying the member of its investor group, and then recording the ties of its investors as the indirect ties of the venture. We observed these contacts for the latest date for which we had an observation on the venture, that is, either the latest investment made in it or the exit from the venture. Depending again on the level of analysis, we either counted the number of non-domestic investors within the indirect ties of the venture or the number of indirect ties to specific non-domestic markets.

As illustrated by the descriptive statistics in Panel C of Table I the number of direct and indirect ties to non-domestic markets present considerable variation. While on the average sample ventures have 1.99 direct and 126.97 indirect non-domestic ties, the distributions of the number of ties show long right-hand tails, which are typical for the distribution of ties in social networks. The same type of distribution is also present in the number of market nations the ventures reach through these ties, as well as in the number of ties to individual markets. While we expect that the number of ties to non-domestic markets have a positive effect to the likelihood of non-domestic exit, we also expect the marginal contribution of additional ties to decrease. Consequently, in the following regressions, we use the square root transformation of the number of ties to account for this reduced contribution of additional ties, both in the general and market-specific measures.

IV. Network Ties and Non-Domestic Exits

A. Methodology

We begin our analyses by testing the first set of hypotheses suggesting that network ties to non-domestic markets increase the likelihood of an exit targeted to non-domestic markets. As described above, the limited observation window creates right censoring, implying that we are unable to observe the outcomes of some of the sample ventures. While lengthening the observation window might reduce the bias, it does not completely cancel it and effectively reduces the sample size. Therefore, instead of estimating the effect of ties to the likelihood of an exit directly, we measure the time from the first investment to the exit, and, applying survival analysis, estimate the effect of co-variates on the hazard rate h(t) that a venture will experience an exit at given time, t.[12] This approach controls for the time a venture has been at risk of an exit at the time of observation, and it is thus well suited to the analysis of our sample as it readily controls for the potential bias resulting from the right-hand censoring.

Specifically, we estimate the proportional hazards model

$$h(t, X(t), \beta) = \lim_{\Delta t \to 0} \frac{P(t \leq T < t + \Delta t | T \geq t, X(t), \beta)}{\Delta t} = h_0(t)^{\beta' X(t)},$$

where $h_0(t)$ is the baseline hazard function and $\exp(\beta' X(t))$ is a venture-specific function of co-variates. The specification implies that each regression coefficient can be interpreted as the proportional effect of absolute changes in the co-variate on the hazard rate. We estimate the model using the Cox semiparametric model, thus making no assumption about the functional form of the baseline hazard rate. To estimate the competing risks of domestic and non-domestic exits, we estimate the risks of both types in separate regressions, treating an exit to the other type as survival (Kalbfleisch and Prentice (1980)).

We include controls for how established and hence visible and credible the venture is by including the *age of the venture at the time of the first investment round*, *the size of the investor group, and the number of rounds of financing received* in the estimated model.

[12] For concise descriptions of the method, see e.g. Ongena & Smith (2001)) and Lo et al. (2002).

We count the age from the year of founding recorded in the Venture Economics data, and if that is unavailable, we record the year of founding as the year of the first investment. We count the size of the investor group as the cumulative number of investors the venture has. In addition, we control for the *home market, industry and year* specific fixed effects by including dummy variables indicating the origin and industry of the venture and the year of the first investment.

B. Results on Non-Domestic Exits

Table II reports the results for the separately estimated Cox proportional hazard models for domestic and non-domestic exits. The first three models in the left-hand column report the results on models estimating the effect of independent variables on the hazard of a domestic exit and Models 4 to 6 in the right-hand panel report the results for the effect on the hazard of a non-domestic exit. As hypothesized, the number of direct and indirect ties to non-domestic markets has a highly significant positive effect on the risk of non-domestic exits. The number of direct ties increases the risk of non-domestic exits while reducing the risk of a domestic exit, while the number of indirect ties increases the risks of exits of both types. To approximate the effect sizes, we use the estimates from Models 3 and 6 to calculate the increases in the hazard rate for an increase of one standard deviation in the numbers of direct and indirect ties from their respective means. This increase in the number of direct ties increases the hazard rate of non-domestic exits by 15.2% and reduces the hazard rate of a domestic exit by 8.5%.[13] A similar increase by one standard deviation in the number of indirect ties increases the risk of a domestic exit by 36.9% and a non-domestic exit by 32.8%.

[13] e.g.: the mean and deviation of the number of direct ties are 1.95 and 1.62, respectively. The effect of direct ties to non-domestic exits when the number of direct ties increases by one deviation from the mean is thus exp((0.287)*(sqrt(1.95+1.62)-sqrt(1.95)))=1.1521%. Therefore, ceteris paribus the increase in the number of direct ties provides a 15.2% increase on the baseline hazard rate.

Table II
Survival Analysis of the Effects of Ties on Exit Destinations

The table reports the results of Cox proportional hazards models analyzing the competing risks of domestic and non-domestic exits. The sample consists of 4559 European ventures that received their first investment round between the years 1990 and 2002. The models predict the exits to domestic (Models 1-3) and non-domestic (Models 4-6) markets, with the other exit destinations being treated as survival. The square roots of the *Number of direct and indirect ties* measure the number and type of ties the venture has to non-domestic markets in general. We observe the exits for the sample ventures until the end of June 2008. While these are not shown, we include control variables for the *year of the first investment round (12), company's home nation (5), and company's major industry group (5)* in all of the analyses. Standard errors are in parentheses. Results marked with ***, **, and * are significant on the .001, .01, and .05 levels, respectively. One-tailed tests for hypotheses, two-tailed tests for controls.

	Exit					
	1. Domestic exit			**2. Non-domestic exit**		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Number of direct ties (sq)	-.038		-.179 *	.454 ***		.287 **
	(.08)		(.08)	(.10)		(.10)
Number of indirect ties (sq)		.041 ***	.046 ***		.049 ***	.041 ***
		(.01)	(.01)		(.01)	(.01)
Cumulative number of investors in investment group	.061 *	-.022	.011	.004	.006	-.043
	(.03)	(.03)	(.03)	(.03)	(.03)	(.03)
Company's age at time of first investment round (ln)	.111 *	.104	.096	.171 **	.147 *	.156 *
	(.06)	(.06)	(.06)	(.07)	(.07)	(.07)
Total number of investment rounds company received	-.086 **	-.116 ***	-.111 **	-.036	-.040	-.047
	(.03)	(.03)	(.03)	(.03)	(.03)	(.03)
Year control						
Company nation control	*Controls included in all analyses but not reported*					
Industry control						
Observations	4559	4559	4559	4559	4559	4559
Events	634	634	634	437	437	437
Log-L	-4974.1	-4955.4	-4953.1	-3412.9	-3404.0	-3400.2
Chi^2	181.7	219.1	223.8	125.8	143.6	151.2

C. Results on Non-Domestic Exit Type

Next, we draw a distinction between the exit destination and exit type. Table III reports the results from the estimations of the Cox proportional hazard models on the four exit types – i.e. a domestic IPO, domestic acquisition, non-domestic IPO, and non-domestic acquisition. We hypothesized that direct ties should increase the risk of a non-domestic IPO exit, where rich information mediation is required, while indirect ties should increase the risk of non-domestic acquisitions, where a medium for information distribution is needed to alleviate the recognition problem.

Table III
Survival Analysis of the Effects of Ties on Exit Destinations and Exit Types

The table reports the results of Cox proportional hazards models analyzing the competing risks of domestic and non-domestic IPO and acquisition exits. Models 1 to 4 predict the exits to domestic IPOs and acquisitions (Models 1 and 2) and non-domestic IPOs and acquisitions (Models 3 and 4), with the other exit destinations being treated as survival. The sample, independent variables, and controls are the same as in Table II. Standard errors are in parentheses. Results marked with ***, **, and * are significant on the .001, .01, and .05 levels, respectively. One-tailed tests for hypotheses, two-tailed tests for controls.

	Exit			
	1. Domestic IPO	**2. Domestic acquisition**	**3. Non-domestic IPO**	**4. Non-domestic acquisition**
Number of direct ties (sq) to non-domestic markets	.013	-.241 **	1.752 ***	.174
	(.16)	(.10)	(.49)	(.11)
Number of indirect ties (sq) to non-domestic markets	.025 *	.053 ***	.016	.042 ***
	(.01)	(.01)	(.03)	(.01)
Cumulative number of investors in investment group	.039	-.012	-.212	-.034
	(.05)	(.04)	(.13)	(.04)
Company's age at time of first investment round (ln)	.286 **	.022	.441 *	.122
	(.10)	(.07)	(.21)	(.07)
Total number of investment rounds company received	-.078	-.130 **	-.033	-.047
	(.06)	(.04)	(.10)	(.04)
Year control	*Controls included in all analyses, but not reported*			
Company nation control				
Industry control				
Observations	4559	4559	4559	4559
events	177	457	40	397
Log-L	-1370.91	-3526.27	-261.11	-3094.84
Chi^2	148.796	186.776	126.102	113.596

Models 3 and 4 in Table III present the estimated effects of direct and indirect ties to non-domestic markets. Supporting our hypotheses, both direct and indirect ties increase the risk of non-domestic exits, although they appear to have differing effects on the two types of exits. Direct ties increase the risk of a non-domestic IPO exit, while indirect ties increase the risk of non-domestic acquisitions. To approximate the magnitude of these effects, we calculate the change in risks when the number of direct and indirect ties increases by one standard deviation from their respective means. For non-domestic IPOs, an increase of one standard deviation in the number of direct ties increases the risk by 137%, according to the parameter estimates of Model 3. The number of direct ties does not have a significant effect on other types of exits, except the risk of domestic acquisitions, the risk of which decreases by 11% when the number of direct ties

increases by one deviation from its mean. Indirect ties, however, increase the likelihood of domestic acquisitions and IPOs and non-domestic acquisitions. The effect of an increase of one standard deviation in the number of indirect ties is an increase of 44% and 34% in the likelihood of domestic and non-domestic acquisitions, respectively.

D. Robustness Tests

To test the robustness of our results, we estimate the effects of network ties using multiple alternative model specifications. First, we address the obvious concern of endogeneity, that is, whether companies with the intention of internationalizing seek both non-domestic investors and non-domestic exit routes. While we believe that in any case the joint occurrence of direct ties and non-domestic exits are partly a result of a venture's intent to internationalize, our argument for the beneficial role of network ties holds, and we expect network ties to facilitate the information transfer even after we control for the endogeneity. To check the robustness of our results against endogeneity, we estimate an instrumental variable model, where we instrument the number of direct ties to a non-domestic market with *the market share of non-domestic VCs* in a venture's home market during the year in which the venture received its first investment[14]. Table IV reports the results from the estimations of ordinary probit and instrumental variable probit models using the indicator for both a non-domestic exit and a non-domestic IPO as dependent variables. The results for each of the models are similar to the corresponding models in Table II and Table III. Both in the ordinary and instrumental variable probit models the direct and indirect ties affect the likelihood of a non-domestic exit positively, while only direct ties affect the likelihood of a non-domestic IPO, which is consistent with the results from survival analyses.

[14] *The market share of non-domestic VCs* satisfies the requirements for an instrumental variable when it is correlated with the endogenous variable (here the number of direct ties) but not with the dependent variable. As the market share of non-domestic VCs affects the venture's opportunity and likelihood of having a non-domestic investor and thus of having a direct tie to a non-domestic market, but does not affect the outcomes of the venture, it is suitable to instrument for the number of direct ties to non-domestic markets. To check the validity of this assumption, we estimate two models where we use the number of direct ties and an exit to a non-domestic market as dependent variables and the market share as an independent variable. The market share of a non-domestic VC positively and statistically significantly affects the number of direct ties, but has no effect on the likelihood of a non-domestic exit, thus confirming its validity as an instrumental variable.

Table IV
Instrumental Variable Probit Models

The table reports the results of instrumental variable probit models analyzing the probability of non-domestic exits and non-domestic IPO exits. The sample and variables are the same as in the previous tables, with the exception that in the instrumental variable models the *market share of non-domestic VCs* instruments the number of direct ties to non-domestic markets. Standard errors are in parentheses. Results marked with ***, **, and * are significant on the .001, .01, and .05 levels, respectively. One-tailed tests for hypotheses, two-tailed tests for controls.

	Non-domestic exit (IPO & acquisition)		**Non-domestic IPO**	
	Probit model	**IV probit model Direct ties instrumented by *Market share of non-domestic VCs***	**Probit model**	**IV probit model Direct ties instrumented by *Market share of non-domestic VCs***
Number of direct ties (sq)	.161 **	.408 *	.730 ***	.954 *
	(.06)	(.24)	(.20)	(.52)
Number of indirect ties (sq)	.021 ***	.014 *	.007	.001
	(.00)	(.01)	(.01)	(.02)
Cumulative number of investors in investment group	-.016	-.066	-.074	-.120
	(.02)	(.05)	(.05)	(.11)
Company's age at time of first investment round (ln)	.085 *	.096 *	.190 *	.200 *
	(.04)	(.04)	(.10)	(.10)
Total number of investment rounds company received	-.006	-.009	-.002	-.005
	(.02)	(.02)	(.04)	(.04)
Year control				
Company nation control	*Controls included in all analyses but not reported*			
Industry control				
Constant	-.976 ***	-1.063 ***	-2.221 ***	-2.300 ***
	(.24)	(.26)	(.43)	(.45)
Observations	4559	4559	4559	4559
Log-L	-1349.8	-4361.1	-162.0	-3173.8
Chi^2	180.6	176.9	134.4	92.1

Second, to check whether the direct and indirect ties have statistically differing effects on the risk of the exit destinations and exit types, we estimate the parameters for the exit destinations jointly, following a procedure for joint estimation suggested by Lunn & McNeil (1995). We first duplicate the data set (quadruplicate for the analysis of both destinations and types), creating two (four) identical observations for each sample venture that differ only in the independent variable. Second, stratifying the models according to the exit type and using interaction variables between the exit type and type of network tie, we are able to estimate the effect of network ties on different exit types

simultaneously. The results from these estimations, reported in Table V confirm the findings that direct ties do indeed have differing effects on the risk of an exit to domestic and non-domestic destinations, and that this difference is statistically significant. Both in Model 1, reporting the effects on domestic and non-domestic exits, and in Model 4, reporting the effects on destinations and types, the direct effect of direct ties is negative, while the direct effect of indirect ties is positive, implying that direct ties to non-domestic markets reduce the risk of an exit, the opposite being true for indirect ties. However, both the interaction term between the non-domestic indicator (in Models 1 and 4) and direct ties, and the interaction between the IPO indicator (in Model 4) and direct ties, are both positive and statistically significant, indicating that while direct ties reduce the risk of an exit, they increase the risk of non-domestic exits and non-domestic IPOs specifically. However, the effect of indirect ties does not make a difference to the exit destinations or exit type, and thus it appears that they do increase the likelihood of an exit generally, but not to any destination specifically.

Third, we test the robustness of our results against the maturity and size of the domestic market, which may affect the coverage of the sample. We re-estimate the Models 1 and 4 of Table V by limiting the sample to include only the last four years of the sample period, 1999-2002, and only those ventures that originate from the five largest nations in the sample: the UK, Germany, France, Sweden, and the Netherlands. As reported in Models 3 and 6, the results are consistent with those estimated using the full sample, with the exception of interaction terms between IPO exits and direct ties. The time from the first investment to the end of the observation window is shortened in the subsample, which reduces the number of observed IPOs and results in reduced level of statistical significance. In addition, we test the effect of right censoring by excluding from the full sample the ventures that received their first round of financing in 1999 or later. Again, as reported in Models 2 and 5, the results are consistent with those from the full sample. While indirect ties have a statistically significant negative interaction with non-domestic exits and IPO exits, the net effect of indirect ties remains positive for non-domestic exits, and zero for non-domestic IPOs.

Table V
Jointly Estimated Effects of Ties on Exit Destinations and Exit Types

The table reports the results of jointly estimated Cox proportional hazards models analyzing the competing risks of exits both to domestic and non-domestic destinations (Models 1-3) as well as through IPOs and acquisitions (Models 4-6). The sample and independent variables are the same as in the previous tables, with the exception of the binary indicator variables for *Non-domestic exit* and *IPO exit*, which have a value of 1 if an exit is made to a non-domestic market or through an IPO, respectively, and otherwise zero. The models apply stratification by failure type and clustering by venture. Standard errors are in parentheses. Results marked with ***, **, and * are significant on the .001, .01, and .05 levels, respectively. One-tailed tests for hypotheses, two-tailed tests for controls.

	Exit (0/1)					
	Full sample	**First round before 1999**	**Five largest markets 1999-2002**	**Full sample**	**First round before 1999**	**Five largest markets 1999-2002**
Number of direct ties (sq)	-0.206 **	-0.249 *	-0.174	-0.344 ***	-0.574 ***	-0.236 *
	(.08)	(.12)	(.11)	(.09)	(.14)	(.12)
Number of indirect ties (sq)	0.051 ***	0.067 ***	0.044 ***	0.053 ***	0.084 ***	0.043 ***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Number of direct ties (sq) X Non-domestic exit (0/1)	0.541 ***	0.637 ***	0.422 **	0.643 ***	0.853 ***	0.475 **
	(.11)	(.18)	(.15)	(.11)	(.18)	(.16)
Number of indirect ties (sq) X Non-domestic exit (0/1)	-0.015	-0.028	0.001	-0.017 *	-0.037 *	0.001
	(.01)	(.02)	(.01)	(.01)	(.02)	(.01)
Number of direct contacts X IPO exit (0/1)				0.509 ***	0.963 ***	0.248
				(.13)	(.19)	(.20)
Number of indirect contacts X IPO exit (0/1)				-0.008	-0.047 **	0.000
				(.01)	(.02)	(.02)
Cumulative number of investors in investment group	-0.018	-0.022	-0.022	-0.024	-0.037	-0.023
	(.02)	(.03)	(.03)	(.02)	(.03)	(.03)
Company age at first investment round (ln)	0.124 **	0.121	0.084	0.125 **	0.121	0.084
	(.04)	(.07)	(.06)	(.04)	(.07)	(.06)
Total number of investment rounds company received	-0.078 ***	-0.184 ***	-0.046	-0.077 **	-0.183 ***	-0.045
	(.02)	(.05)	(.03)	(.02)	(.05)	(.03)
Year control						
Company nation control	*Controls included in all analyses, but not reported*					
Industry control						
Observations	9118	2234	5308	18236	4468	10616
Events	1071	413	533	1071	413	533
Log-L	-8401.24	-2690.15	-3947.11	-8390.3	-2676.68	-3945.84
Chi2	319.224	156.119	130.64	345.4	188.831	133.255

Fourth, we test the robustness of the results against the assumption of a continuous survival time implied by the use of Cox proportional hazards model. While we measure the time to exit in days, we identify the date of founding on the level of years, thus causing interval-censoring. Therefore, to check the robustness of the results, we re-estimate the models assuming discrete time and grouping our observations of foundings and exits on a yearly level. The results of the estimations, implemented with multinomial logistic regression, are qualitatively identical to the ones presented, suggesting that the results are robust and that the use of Cox proportional hazards model is valid.

V. Network Ties and the Destinations of Exits

A. Methodology

As demonstrated by the results above, direct and indirect ties appear to increase the risk of an exit to non-domestic markets in general. Next, we address the second set of hypotheses suggesting that direct and indirect ties should also affect to which specific market the exit is made. For this end, we investigate the exit destinations of those of the sample ventures that have made a non-domestic exit. Should the direct and indirect ties mediate information as predicted, we expect to observe that ventures are more likely to make an exit to those markets that they are connected to through direct or indirect ties. We analyze the exit destinations of the 437 sample ventures with a non-domestic exit destination. We use venture-market pairs as our unit of analysis, pairing the ventures with the potential exit markets and using an indicator variable to record whether the venture exited to a specific market. We define as the set of potential exit markets for the sample ventures those markets which, in the case of an IPO, at least one company has made an IPO to, and in the case of a trade sale, at least one acquisition has been made from. We identify these markets using all the recorded IPOs and acquisitions in the New Issues and Mergers and Acquisitions databases. These databases contain records for acquisitions from 1978 and for IPOs from 1970. We identify 203 nations, 201 market nations for acquisitions and 83 markets for IPOs. After counting for the emergence and exit of nations, such as the Czech Republic and Slovakia, during the period between 1990 and June 2008, our sample consists of 30948 venture-market nation pairs.

We estimate the likelihood of an exit to a specific market using logistic regression.[15] As independent variables, we use the square roots of the numbers of direct and indirect ties to each individual market. We include the following venture-specific controls in the regressions: *the number of foreign investors in the investor group of a venture; the number of rounds of financing received; the age of the venture at the time of the exit; the time from the first investment to the exit in years; the total number of markets the exit was made to*, e.g. in the case of listing to multiple markets, and *dummy variables indicating the industry* of the venture. In addition, we include controls specific to the home market and potential target markets. First, we control for *geographical and cultural distance between the home and target market*, including a measure of the geodesic distance between the capital cities of the two nations and a dummy variable indicating whether the two nations share a common language.[16] Second, we control for the acquisition and IPO activity in the home and target markets, as well as the prevalence of acquisitions and IPOs between the markets. The *outflow of exits from the home market* is the number of non-domestic acquisitions and IPOs divided by the number of all the companies that have been acquired or have made an IPO and are from the same market as the venture. *The inflow of exits to the target market* is the number of IPOs by non-domestic companies to the target market or the number of non-domestic companies acquired by firms from the target market divided by the number of all acquisitions and IPOs made by firms in the target market. *The directed outflow from the home to the target market* is the number of non-domestic IPOs and acquisitions from the venture's home market to the target market divided by all the non-domestic acquisitions and IPOs of the home market. *The relative activity of markets* is the difference between the number of IPOs and acquisitions in the target market and home market with respect to the number of IPOs and acquisitions in the home market. The market-related controls – outflow of exits, inflow of exits, directed outflow, and relative activity – are calculated as the sum of the exit types in the models with a market-venture pair as the dependent variable, and independently for both exit types in the models with

[15] As the share of positive outcomes is approximately 0.5% of the total, we check for the robustness of the estimates of logistic regression by also estimating the models using rare events logistic regression (King and Zeng (2000), King and Zeng (2001)). The results of these regressions are qualitatively identical to those presented below.

[16] For distance and language data, we use a data set provided by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), augmented with data from the CIA World Factbook for those combinations of home and target nations not recorded in the database of CEPII.

exit nation-exit type-venture triplets as the dependent variable. All the market-related controls are measured for the year of the exit from venture.

B. Results on Exit Destinations

Table VI presents the estimated logistic regressions. We examine the hypothesized effects of network ties by estimating the effects of network ties on the likelihood of an exit to a specific market on the level of 203 market nations. Model 1 reports the base model, estimating the effect of control variables on the exit market selection. The effect of distance is significant and negative, as expected on the basis of earlier studies on the effects of distance on investments. This indicates that ventures making a non-domestic exit prefer markets that are geographically near to their domestic market. The coefficient of the variable indicating a common official language between the venture's home market and the exit market is also negative. This is likely to be due to the home markets of the sample ventures, of which only the UK shares an official language with the US, the largest exit market for the sample ventures. In Model 2, we include the measures for the amount of network ties the venture has to the target market. We find that the coefficients of both the direct and indirect ties to a market are positive and statistically significant, implying that the existence of such network ties increases the probability of an exit to this market, and the higher the number of network ties, the higher the positive effect[17]. These results provide support for our hypotheses that direct and indirect ties provide a mechanism for information distribution and consequently mitigate the effect of network ties on the proximity preference. The better connected a venture is to a specific market, the better the opportunities it has to find new investors from that specific market.

[17] While because of space constraints we here report only the results from a model including both the measures of direct and indirect ties, both of the variables are also positive and statistically significant on the level of 0.001 when entered individually into the estimated equation.

Table VI
Logit Analysis of the Effects of Ties on Exit Destinations

The table reports the results of logistic regression on the likelihood of the exit of a venture to a given market nation using a venture-market nation pair as the unit of analysis. The dependent variable receives a value of 1 if the venture made an exit to the focal market nation, zero otherwise. The sample consists of 437 non-domestic exits from European ventures that received their first investment round between 1990 and 2002 and were exited prior to June 2008. The *Number of direct and indirect ties* measures the number of these ties. *Distance* is the logarithm of the geodesic distance between the capital cities of the venture's home market and the focal market. *Common official language* records whether the venture's home nation and focal market share an official language. *Outflow of exits from home market* is the number of non-domestic exits divided by the total number of companies that were acquired or made an IPO and were from the same market as the venture. *Inflow of exits to target market* is the number of IPOs by non-domestic companies in the target market plus the number of non-domestic companies acquired by firms of the target market divided by the number of all acquisitions and IPOs made by firms in the target market. *Directed outflow from home to target market* is the number of non-domestic IPOs and acquisitions from the venture's home market to the target market divided by all non-domestic acquisitions and IPOs in the home market. *Relative activity of markets* is the difference between the number of IPOs and acquisitions in the target market and home market with respect to the number of IPOs and acquisitions in the home market. All market-related controls are measured for the year of the venture's exit. While these are not shown, we include control variables for the *company's major industry group (5)* in all of the analyses. Standard errors are in parentheses. Results marked with ***, **, and * are significant on the .001, .01, and .05 levels, respectively. One-tailed tests for hypotheses, two-tailed tests for controls.

	Exit to focal market				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Number of direct ties (sq) to focal market		2.242 ***	-2.649		-3.535 *
		(.32)	(1.61)		(1.90)
Number of indirect ties (sq) to focal market		0.151 ***		0.566 *	0.928 **
		(.03)		(.26)	(.31)
Number of direct ties (sq) to focal market X Distance			0.713 ***		0.750 **
			(.20)		(.24)
Number of indirect ties (sq) to focal market X Distance				-0.033	-0.096 **
				(.03)	(.04)
Distance (ln)	-0.341 ***	-0.563 ***	-0.620 ***	-0.515 ***	-0.558 ***
	(.09)	(.09)	(.09)	(.10)	(.10)
Common official language	-1.578 ***	-1.055 **	-1.055 **	-1.300 ***	-1.009 **
	(.35)	(.33)	(.33)	(.34)	(.32)
Number of exit markets	0.331 **	0.376 **	0.366 **	0.354 **	0.380 **
	(.12)	(.13)	(.13)	(.12)	(.13)
Cumulative number of foreign investors in investment group	-0.020	-0.502 ***	-0.462 ***	-0.289 ***	-0.521 ***
	(.06)	(.10)	(.10)	(.09)	(.11)
Total number of investment rounds company received	0.031	-0.027	0.000	-0.015	-0.028
	(.10)	(.12)	(.12)	(.11)	(.12)
Company's age at time of exit (ln)	0.086	-0.049	0.054	-0.142	-0.095
	(.24)	(.25)	(.25)	(.25)	(.25)
Time to exit (in years)	-0.035	-0.010	-0.022	-0.004	-0.002
	(.07)	(.08)	(.08)	(.08)	(.08)
Outflow of exits from home market	1.700 *	1.368	1.456	1.702 *	1.500
	(.76)	(.80)	(.80)	(.77)	(.80)
Inflow of exits to target market	-0.664	-0.124	-0.269	-0.200	-0.125
	(.39)	(.37)	(.37)	(.37)	(.38)
Directed outflow from home to target market	18.447 ***	13.239 ***	13.834 ***	14.276 ***	13.252 ***
	(.83)	(.88)	(.88)	(.89)	(.89)

Relative activity of target market to home market	0.004 *	0.002	0.000	0.005 *	0.001
	(.00)	(.00)	(.00)	(.00)	(.00)
Industry controls	*Controls included in all analyses, but not reported*				
Constant	-4.026 ***	-1.775 *	-1.431	-2.242 *	-1.786 *
	(.83)	(.84)	(.87)	(.90)	(.91)
Observations	33329	33329	33329	33329	33329
Chi2	779.21	946.94	940.83	899.91	957.99
Log-Likelihood	-672	-588.1	-591.2	-611.7	-582.6

The positive effect of network ties on the probability of an exit to a focal market suggests that network ties provide an additional independent factor that affects investors' investment behavior, in addition to the distance. To examine whether this effect is moderated by the distance to the target market, we enter the interaction terms of distance and network ties into Models 3 to 5. When entered independently, the interaction term with direct ties is positive and highly significant, but the interaction term with indirect ties appears statistically insignificant. When estimated simultaneously, the effect of the interaction term with direct ties remains the same, while the coefficient of the interaction term with indirect ties becomes significant. However, this may be partly due to the collinearity of the interaction terms, which may inflate the significance when estimated simultaneously. Thus, the evidence on the moderating effect of distance of the effect of indirect ties remains indecisive.

While we can readily observe the direction of the direct effect of the direct and indirect ties on the probability, given the non-linear nature of logistic regression the magnitude of the effect depends on the level of the variables. Furthermore, the interpretation of the interaction effect within a logistic model is not readily deductible from the interaction coefficient, as the effect is dependent on the values of other variables (Hoetker (2007), Ai and Norton (2003)). To examine these effects, we calculate both the effects of direct and indirect ties on the probability and the effect of the interaction of direct ties with the distance, and present the predicted probability with respect to the number of network ties in Fig. 1. Panel a) of the figure presents the effect of network ties on the probability of an exit to a focal market on the basis of the estimates of Model 2 in Table VI. We observe that when the other variables are held at their mean, both types of ties have an increasing positive effect on probability, and when scaled with the maximum values of

the respective types of ties, the effects of both types of ties are of relatively similar magnitude. In Panel b) we plot the effect of direct ties on three levels of distance to focal markets on the basis of the estimates in Model 5. Again, if the other variables are held at their mean, we observe that the direct ties increase the probability of an exit more when the distance to the focal market is higher. Alternatively, we can interpret the result as an indication that the higher the number of direct ties to the market is, the less the mitigating effect of distance on the probability of an exit to the focal market will be.

C. Results on Types of Exits

Table VII reports the results of the models examining the final set of hypotheses, that is, whether the types of ties to a non-domestic market affect the information transfer and, consequently, the probability of given exit types. We hypothesized that direct ties mediate rich information with credibility, thus increasing the likelihood of an IPO to a specific market, while indirect ties provide access to the information distribution, which will affect the likelihood of an acquisition from a specific market. Consequently, using the 201 acquisition markets and 83 IPO markets as exit destinations, we estimate the regressions using the venture-market type pairs as the unit of analysis, thus differentiating between acquisitions and IPO exits. That is, the binary dependent variable receives a value of one if the venture made an exit to the market of the specific type and nation.

Models 1 and 2 present the base model and the model with direct and indirect ties, which essentially coincide with Models 1 and 2 in Table VI, with the exception that the exit market now also distinguishes the type of exit, which is indicated by the binary control variable *IPO exit,* which has a value of 1 if the exit market type is an IPO. In Models 3 and 4 we add the interaction terms between direct and indirect ties individually in the regressions, and Model 5 presents the full model. As predicted by the hypothesis, the coefficient of interaction term between direct ties and the exit type is positive and significant, indicating that direct ties to a specific market especially increase the likelihood of an IPO. The independently added interaction term between indirect ties and the exit type turns out to be insignificant, while, when included as part of the full model, the coefficient is negative on a statistically significant level.

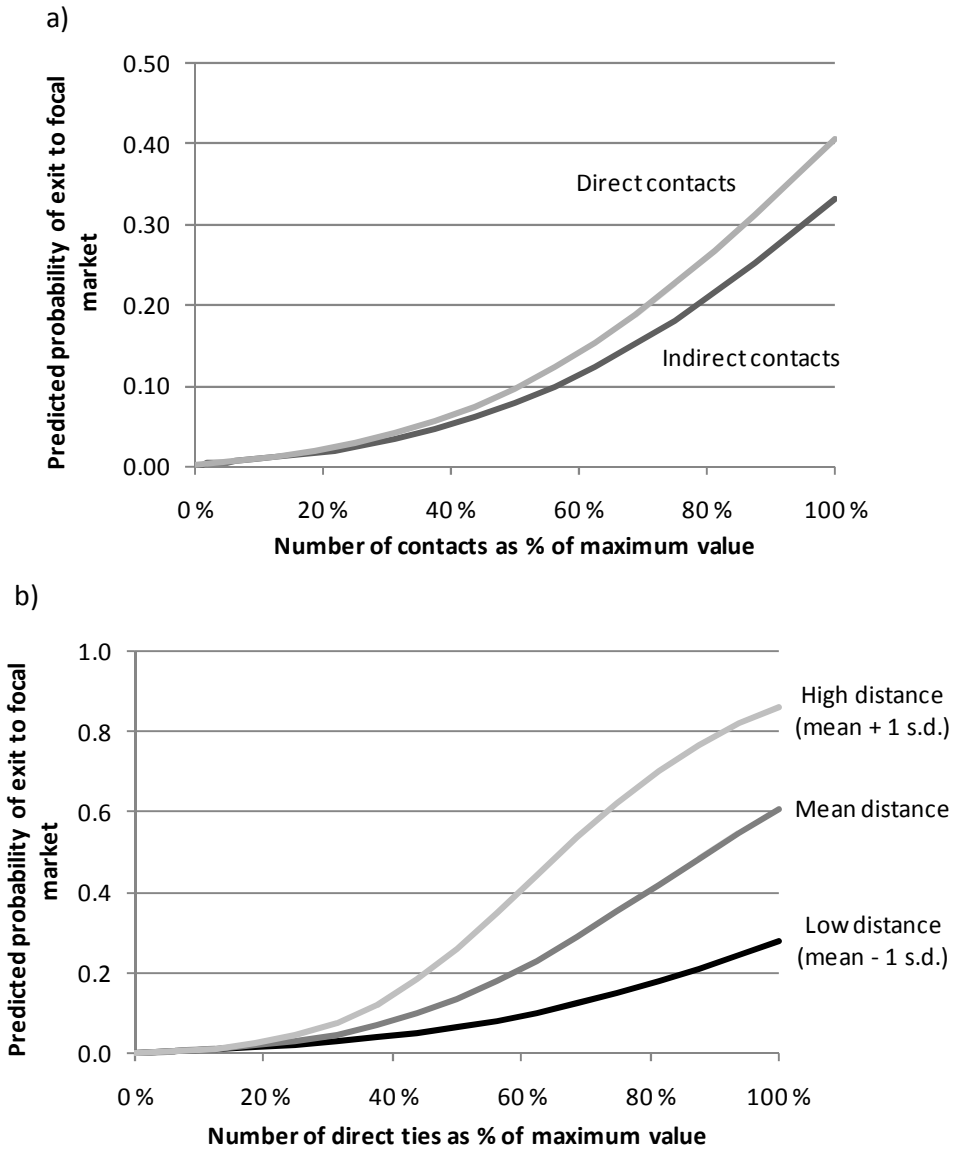

Fig. 1. The Predicted Probabilities for an Exit to the Focal Market at Given Level of Direct and Indirect ties to the Market.

Panel a) presents the effect of direct and indirect ties on the probability of an exit to the focal market, and panel b) presents the moderating effect of distance on the effect of direct ties on this probability. In both panels the x-axis presents the number of direct and indirect ties scaled by the largest number of ties of respective types (8 for direct, 1607 for indirect ties). Panel a) is based on the estimates of Model 2 in Table VI and b) on Model 5 in the same table.

Table VII
Logit Analysis of the Effects of Ties on Exit Destinations and Exit Types

The table reports the results of logistic regression on the likelihood of the exit of a venture to a given market using a venture-market type pair as the unit of analysis. The models predict the exits to the 83 IPO and 201 acquisition markets, controlling for the exit market type. The sample, independent variables and controls are the same as in Table VI except for market-related controls, where we use the number of IPOs and acquisitions independently, depending on the exit market type. While these are not shown, we include control variables for the *company's major industry group (5)* in all of the analyses. Standard errors are in parentheses. Results marked with ***, **, and * are significant on the .001, .01, and .05 levels, respectively. One-tailed tests for hypotheses, two-tailed tests for controls.

	Exit to focal market				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Number of direct ties (sq) to focal market		2.556 ***	3.013 ***		1.805 ***
		(.29)	(.25)		(.35)
Number of indirect ties (sq) to focal market		0.120 ***		0.290 ***	0.183 ***
		(.03)		(.03)	(.03)
Number of direct ties (sq) to focal market X IPO Exit (0/1)			0.887 *		2.622 ***
			(.41)		(.63)
Number of indirect ties (sq) to focal market X IPO Exit (0/1)				-0.049	-0.218 ***
				(.04)	(.06)
IPO exit (0/1)	-2.671 ***	-2.161 ***	-2.892 ***	-1.975 ***	-2.751 ***
	(.38)	(.33)	(.49)	(.37)	(.48)
Distance (ln)	-0.453 ***	-0.609 ***	-0.571 ***	-0.599 ***	-0.629 ***
	(.07)	(.07)	(.07)	(.07)	(.07)
Common official language	0.276	-0.045	-0.005	-0.028	-0.113
	(.20)	(.21)	(.21)	(.21)	(.22)
Number of exit markets	0.338 **	0.322 **	0.326 **	0.316 **	0.318 **
	(.12)	(.12)	(.12)	(.12)	(.12)
Cumulative number of foreign investors in investment group	-0.008	-0.554 ***	-0.460 ***	-0.321 ***	-0.526 ***
	(.06)	(.10)	(.09)	(.08)	(.10)
Total number of investment rounds company received	0.059	0.013	-0.014	0.052	-0.027
	(.08)	(.10)	(.10)	(.10)	(.10)
Company's age at time of exit (ln)	0.095	-0.094	-0.020	-0.127	-0.123
	(.22)	(.23)	(.23)	(.23)	(.24)
Time to exit (in years)	-0.017	0.024	0.014	0.015	0.028
	(.07)	(.07)	(.07)	(.07)	(.07)
Outflow of exits from home market	1.154 +	1.573 *	1.253 *	1.900 **	1.457 *
	(.63)	(.62)	(.63)	(.61)	(.63)
Inflow of exits to target market	0.017	0.246	0.199	0.210	0.236
	(.28)	(.31)	(.31)	(.30)	(.31)
Directed outflow from home to target market	10.378 ***	7.344 ***	8.069 ***	7.706 ***	7.761 ***
	(.53)	(.54)	(.60)	(.53)	(.60)
Relative activity of target market to home market	0.003 *	0.001	0.001	0.003 *	0.002
	(.00)	(.00)	(.00)	(.00)	(.00)
Industry controls	*Controls included in all analyses, but not reported*				
Constant	-3.020 ***	-1.373	-1.671 *	-1.647 *	-1.102
	(.71)	(.72)	(.72)	(.71)	(.72)
Observations	46198	46198	46198	46198	46198
Chi^2	570.7	794.0	780.6	726.8	812.9
Log-Likelihood	-831.6	-719.9	-726.6	-753.5	-710.5

The results appear to support our hypothesis on the differential effects of network ties on the type of information distribution and the consequent exit type. While direct ties increase the probabilities of both the IPOs to and acquisitions from a focal market, the effect is markedly higher for the IPO exits. However, the evidence for the effect of indirect ties on an acquisition exit is ambivalent. While indirect ties have a direct positive effect on both market types, the moderating effect distinguishing between the types of exit receives only partial support. When we calculate the effect of ties on the probability of an exit to a focal market type on the basis of the estimates in Model 5 and plot it against the number of ties scaled by the maximum number of respective types, as illustrated in Fig. 2, the effect of indirect ties on IPOs appears minimal. Direct ties mostly affect the likelihood of an IPO exit, with some effect on acquisitions too, and indirect ties have a significant effect specifically on the likelihood of an acquisition. Thus, indirect ties do not have any effect on the probability of an IPO exit, suggesting that they fail to distribute information of sufficient credibility, as hypothesized, while direct ties provide both the recognition and evaluation of targets, with the emphasis being on the latter. It appears that while direct ties distribute rich information that increases investors' confidence in information regarding potential investment targets, they also reduce the problem of recognition by distributing information. However, indirect ties, which provide a wider reach for simple information, have a greater effect on the reduction of the recognition problem.

In an auxiliary analysis, we re-estimate the results with a restricted sample to test the effects of limiting sample nations to the five largest nations and focusing on the ventures with the first investment round taking place in or prior to the year 1998. All the results for both the direct effects and the moderated effects of direct and indirect ties remain qualitatively identical when estimated using each restricted sample.

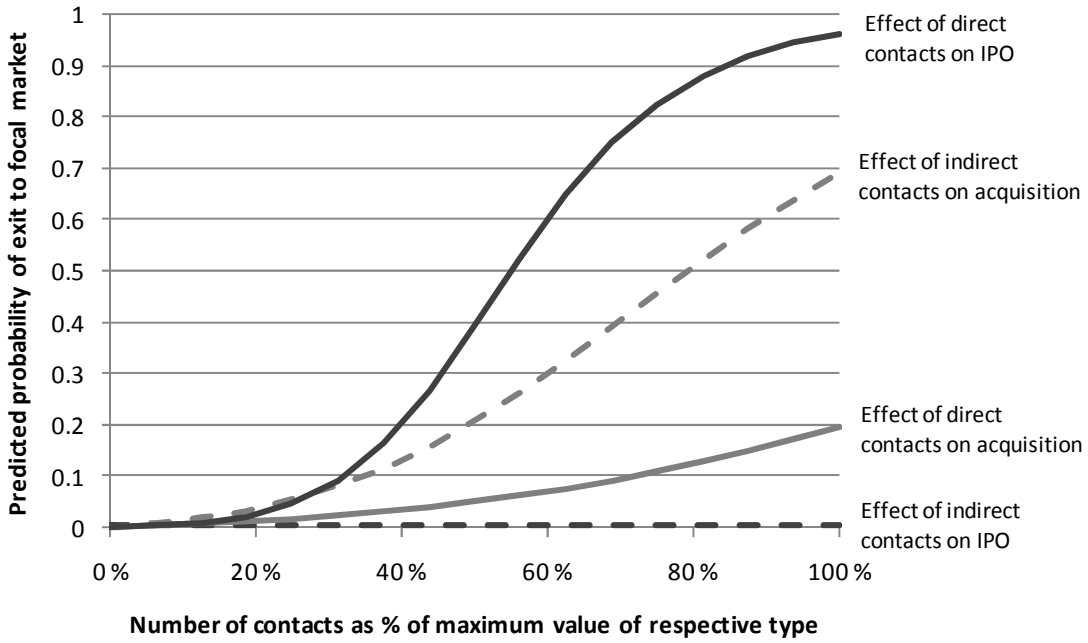

Fig. 2. The Predicted Probabilities of the Type of Exit to the Focal Market at a Given Level of Ties.

The x-axis presents the number of direct and indirect ties scaled by the largest number of ties of the respective types (8 for direct, 1607 for indirect ties). The predicted values are estimated using Model 5 in Table VII. Solid and dashed lines present the effects on direct and indirect ties, respectively. The lines marked "IPO" and "Acquisition" present the effect of ties on the probability of an exit through the indicated type to the focal market. Other variables are held at their means.

VI. Discussion and Conclusions

In this paper we set out to examine the roles of direct and indirect ties in distributing different types of information and consequently mitigating the effects of investors' preference for proximity on the opportunities of firms seeking financing. We examined both the likelihood of non-domestic exits and the exit market selections of those ventures that made a non-domestic exit. We found that the network ties of the sample ventures increase the likelihood of a non-domestic exit in general and affect the selection of the exit market, increasing the probability of an exit being made to those markets to which the venture has pre-existing investor network ties. As predicted, we also found that direct and indirect network ties differ in their capability to help mitigate two key problems related to imperfect information, the identification of investment opportunities and the evaluation of their quality, in investments by geographically distant investors. As indirect ties provide a broad reach they help alleviate the

identification problem but direct ties, with their stronger certification effects, are effective in mitigating the quality evaluation problem. Our results demonstrate that indirect ties provide reach but not richness, reducing the opportunity identification problem. On the other hand, direct ties appear to serve as a channel for rich information transfer, reducing the problems of investor quality assessment, and consequently they facilitate IPO exits to those markets the venture is connected to. Thus, the structure of the network ties of financial intermediaries is consequential for the distribution of information.

These results contribute to the literature concerning the proximity preference, or local bias, of investors by demonstrating the significance of inter-organizational ties, and thus contributing to the attempts to make the distance-related mechanisms of information distribution explicit. From the perspective of our results, the preference for proximity appears as a problem of the distribution and reception of information. Thus, what is consequential is not the geographical distance as such, but the investors' connectedness. While this connectedness is closely correlated with physical distance, those investors that are able to connect to non-local markets despite the distance have a smaller social distance from these markets and consequently reap better information from these markets. As we were able to observe these effects using data on co-operation relationships based on formal relationships between venture capital organizations, we expect the effects to be considerably more pronounced when the personal contacts of individual investors and traders are examined. This provides an interesting direction for further research.

Our results also make several contributions to practice and policy. For entrepreneurs, our results show that early-stage financing choices can have long-standing consequences for the development of their ventures. Not only having a foreign investor, but even domestic investors with strong international syndication networks can lead to accelerated development towards an international exit. Given that the functioning of the exit market is crucial for functioning venture capital markets (Black and Gilson (1998)), these findings are also important for venture capitalists, institutional investors, and policy-makers. For venture capital investors, this new understanding gives additional justification for internationalization strategies and cross-border syndication. Even if

cross-border syndicates are more challenging to build and manage than domestic ones, this paper suggests that it may be valuable for the ability of the investor to make successful international exits. For institutional investors investing in markets with constrained domestic exit opportunities, the findings of the paper suggest that the international syndication of venture capital firms could be one valuable factor to add to the evaluation criteria when making fund investments. Finally, for policy-makers, the findings show that encouraging international venture capital activity can help to improve the opportunities for the creation of value from the investments made in science, technology, and innovation. The more exit opportunities there are, the higher the valuations and the better the returns on early-stage technology investments.

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